ALPHA MICROSYSTEMS
RIGHT. FROM THE START
ALPHA MICROSYSTEMS
RIGHT. FROM THE START
ALPHA MICROSYSTEMS
RIGHT. FROM THE START
ALPHA MICROSYSTEMS
RIGHT. FROM THE START
ALPHA MICROSYSTEMS
RIGHT. FROM THE START
ALPHA MICROSYSTEMS
RIGHT. FROM THE START
ALPHA MICROSYSTEMS
RIGHT. FROM THE START
ALPHA MICROSYSTEMS
RIGHT. FROM THE START
ALPHA MICROSYSTEMS
RIGHT. FROM THE START
ALPHA MICROSYSTEMS
RIGHT. FROM THE START

ALPHA MICROSYSTEMS
RIGHT. FROM THE START
ALPHA MICROSYSTEMS
RIGHT. FROM THE START
ALPHA MICROSYSTEMS
RIGHT. FROM THE START

Diskette
Configuration Guide

DSS-10402-00,Rev.A03

REVISIONS INCORPORATED	
REVISION	DATE
00	Feb. 1991
01	Sept. 1991
02	Apr. 1992
03	Feb. 1994

Diskette Configuration Guide
To re-order this document, request part number DSS-10402-00.

ALPHA MICROSYSTEMS
2722 S. Fairview Street
P.O. Box 25059
Santa Ana, CA 92799

TABLE OF CONTENTS

1.0 INTRODUCTION

With the addition of VPC (Virtual Personal Computer) to the Alpha Microsystems product line, the need for enhanced diskette support has grown. With appropriate modifications to the currently available diskette controllers and drives, VPC is able to provide full double and high density diskette support on both 5-1/4 and 3-1/2 inch drives. This enhanced capability is enabled without sacrificing compatibility with current AMOS diskette formats.

When applied to a single controller and drive type, these changes are straightforward and quite understandable. However, with a large variety of diskette formats, controllers, diskette drives, and media types available, these modifications and configurations can seem quite confusing and inoperable. It is the purpose of this document to detail and organize the diskette system configurations, and to serve as a reference for installation and setup of diskette systems.

This document will deal only with 5-1/4 and 3-1/2 inch diskette drives connected to an AM-2000M, AM-212 VME, or AM-214 controller. It will not address eight inch diskettes or S-100 controllers.

2.0 DISKETTE FORMATS

All of the diskette formats used under AMOS and VPC use soft sectored diskettes. This means that the format of the sectors on the diskette can be controlled by software. As such, many different formats are possible. During the early development of systems which used diskettes, manufacturers devised formats which suited their particular needs. Alpha Micro also developed unique formats at this time. As these systems have evolved, a set of standard formats has emerged as used on the IBM PC. These formats, for both AMOS and the PC, are detailed below.

2.1 5-1/4 Inch AMOS Formats

AMOS supports a variety of diskette formats on 5-1/4 inch drives. Until VPC was introduced, all 5-1/4 inch systems operated in a fixed density mode. The 5-1/4 inch drive operated as a single or double density, 96 TPI (tracks per inch) unit. The most common 5-1/4 inch AMOS format is double sided, double density AMS format, yielding a total capacity of 800KB per diskette. A variety of alternative formats are available, including STD and IMG formats, by using a program to build a specialized driver. These formats are compatible with obsolete AMOS formats and the IBM 3740 format. These formats are used for compatibility and are generally not used for archival or data exchange between current systems.

2.2 3-1/2 Inch AMOS Formats

With the advent of the smaller AM-1400 and AM-1600 systems, 3-1/2 inch high density diskettes are also supported. The 3-1/2 inch quad density format used in these systems yields a capacity of 1.44MB per diskette. Apart from the sector interleave, this format is identical to the IBM PS-2 3-1/2 inch quad density format described below.

2.3 5-1/4 Inch PC Formats

The IBM PC supports two standard diskette formats on a 5-1/4 inch drive. The first is double sided, double density, 48 TPI, which yields a capacity of 360KB per diskette. This is the most common and compatible PC format. The second format was introduced with the PC-AT. It is double sided, quad density 96 TPI, with a total capacity of 1.2 MB. This format requires a high density or dual density drive. The standard double density drive rotates at a speed of 300 RPM. A high density drive rotates at 360 RPM. This higher rotational speed, coupled with a faster data transfer rate, results in the higher capacity.

There is also a difference in the diskette itself. The high density drive records data with much lower intensity than its lower capacity counterpart. This lower write current allows greater data density. However, it also requires a finer formulation in the magnetic coating of the diskette. Used in a low density drive, recording bleeds from one track to the next, causing data corruption. Conversely, using a standard double density diskette in a high density drive results in insufficient write current to properly record data. Therefore, you must use the proper media for the format and drive type in use.

A dual density drive is able to operate in either mode. 5-1/4 inch dual density drives sense a signal on the interface which forces the drive into the proper mode. By controlling this signal, the system software can control which format will be used.

The original PC-AT simulated the lower capacity 360KB double density mode on a high density drive. While it is possible to read and write double density diskettes for use on that system, using the more inexpensive media, those diskettes may not be readable on a real double density or dual density drive. This is mentioned here since VPC uses a true dual density method to record double density diskettes and, therefore, may not be able to read the simulated ones produced on a high density drive.

The PC originally produced 360KB diskettes on a 48 TPI (tracks per inch) drive. The diskettes used were known as 2D (2 sides, double density). A dual density drive can operate in either double density or high density mode. Dual density drives are 96 TPI units and can record twice as many tracks in the same area. These higher capacity units use 2DD (2 sides, double density, double track) media. This is the same media used for the standard AMS format. In order to emulate a double density 48 TPI drive, only the even tracks are recorded, with the odd tracks being skipped. Since a double track drive is being used, 2DD media must be used to record these 360KB diskettes.

5-1/4" Inch PC Diskette Formats

Drive Type	Speed	Transfer Rate	Cylinders	Sectors	Capacity	Media Type
Double Density	**300 RPM†**	**250 Kbs†**	**40**	**9**	**360KB**	**2D***
High Density	**360 RPM**	**500 Kbs**	**80**	**15**	**1.2MB**	**2HD**

* On a 96 TPI drive, only the even tracks are recorded. The odd tracks are skipped. 2DD media must be used for this mode.

† On machines with only a high density drive (360 RPM), this mode is emulated by using a transfer rate of 300Kbs. Diskettes produced in this manner may not be readable on double density drives.

2.4 3-1/2 Inch PC Formats

The IBM PS-2 introduced two standard 3-1/2 inch diskette formats. The first is a double sided, double density, 135 TPI format yielding a capacity of 720KB. The other is double sided, quad density, 135 TPI, with a total capacity of 1.44 MB. Both of these formats are recorded at the same rotational speed of 300 RPM. The high density format is recorded with a reduced write current on a special high density media. The same principles regarding standard and high density media on 5-1/4 inch drives apply to the 3-1/2 inch drives. While the media types are more similar in the 3-1/2 inch format, a physical difference in the diskette shell differentiates the media types. The high density diskette shell contains a small window which can be used by the drive to sense which type of media is installed. Most 3-1/2 inch dual density drives are set up to sense this window and set the proper operating mode. An interface signal is not necessary.

3-1/2" Inch PC Diskette Formats

Drive Type	Speed	Transfer Rate	Cylinders	Sectors	Capacity	Media Type
Double Density	**300 RPM**	**250 Kbs**	**80**	**9**	**720KB**	**2DD**
High Density	**300 RPM**	**500 Kbs**	**80**	**18**	**1.44MB**	**2HD**

2.5 Combining AMOS and PC Formats

With properly configured dual density drives and a revised controller board, all of the above formats can be realized. The AMOS formats remain intact with standard unmodified system drivers. The PC formats are available under VPC 1.0A and later. The following sections describe the hardware revision levels and diskette drive requirements to accomplish dual density operation.

3.0 DISKETTE CONTROLLER HARDWARE

The following paragraphs discuss the currently available diskette controllers on systems which support VPC. All of these controllers are based on the Western Digital 2791 diskette controller. The controllers discussed are:

1. AM-2000M Embedded Controller
2. AM-212 VME Bus Controller
3. AM-214 Compact Systems Controller

Each of these controllers contains the circuitry necessary to read, write, and format AMOS compatible diskettes on the drives available for its particular system type. In some cases, modifications to the original controller are necessary to add dual density and/or high density capabilities. For installation and initial configuration for AMOS diskette operation, refer to the installation instructions provided with each of the subsystems. Additional jumper configurations are shown below for VPC dual density operation.

3.1 AM-2000M Embedded Controller

The AM-2000M has a WD2791 socket on the main PC board. This IC may be added as an option at purchase, or as a field upgrade. When the IC is field installed, it is often necessary to calibrate the data separator, read compensation, and write compensation circuits. The calibration procedure is outlined in Appendix A of this document. AM-2000M revision A and B boards contain 8k of diskette memory. This is sufficient for reading and writing all diskette types, but not enough to format high density diskettes, which require more than 8k of data per track. Preformatted diskettes are readily available from most computer supply outlets. The diskettes can also be formatted on another computer which has high density formatting capability. Revision C boards and later contain 32k of memory, allowing full operation on all diskette formats. In order to control the high density interface pin for 5-1/4 inch drives, a modification is required to feed the necessary control signal to the diskette drive connector.

Modifications change the AM-2000M revision levels as follows:

For 16 MHz. AM-2000M (DWB-00145-00)
from A05 to A06 *
from B08 to B09 *
from C03 to C04

For 33 MHz. AM-2000M (DWB-00145-33)
from B12 to B13 *
from C07 to C08

* Will read and write all formats. Cannot format high density

3.1.1 AM-2000M Diskette Controller Jumper Settings

There are two jumper blocks in the diskette control circuitry on the AM-2000M main board. The first is W1A, located next to U46 and U72A. This jumper must be installed for diskette operation. It supplies the main clock signal to the controller chip. The second jumper is W501 and is located between U35 and U36. This jumper must be installed, since it allows software control of the diskette data rate. See Figure A-1 in Appendix A for jumper locations.

3.2 AM-212 VME Bus Controller

The AM-212 is used in AM-2000 and AM-3000 VME bus based systems. In order to read, write, and format high density diskettes, a modification is required to feed the high density control signal to the diskette drive connector. This modification also enables on-board circuitry which allows formatting high density diskettes with only 8k of memory. This modification changes the board revision level from A04 to A05

3.2.1 AM-212 Jumper Settings

The AM-212 contains a number of jumper blocks. The jumper settings shown in Figure 1 will provide proper operation in all modes. The settings shown are correct for an AM-212 board plugged into the P1 side of the VME bus. The AM-212 may also be connected on the P2 side of the VME bus. For operation on the P2 side, install the P2 IRQ jumper.

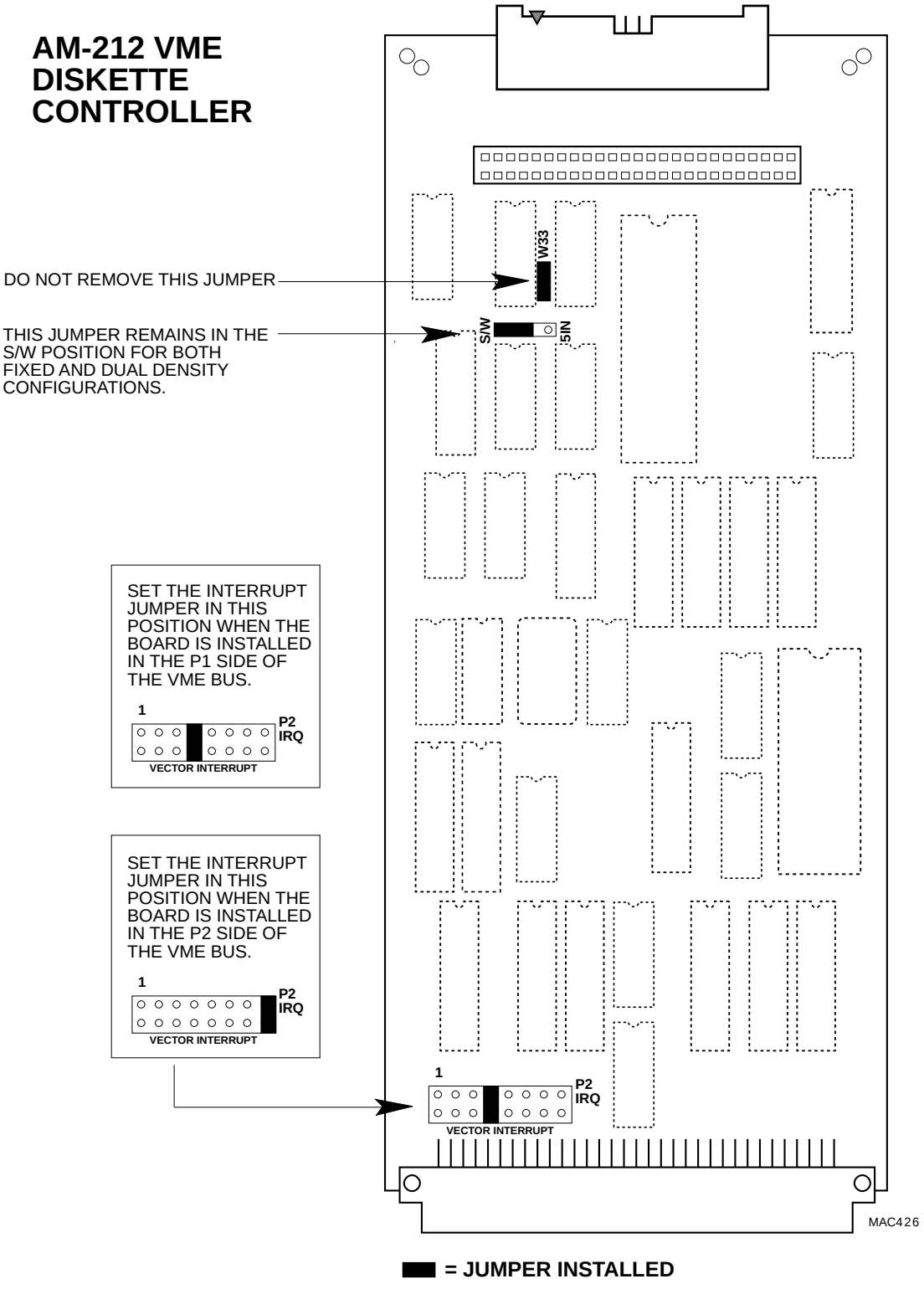

AM-212 VME
DISKETTE
CONTROLLER
DO NOT REMOVE THIS JUMPER
THIS JUMPER REMAINS IN THE S/W POSITION FOR BOTH FIXED AND DUAL DENSITY CONFIGURATIONS.
W33
S/W
5IN
SET THE INTERRUPT JUMPER IN THIS POSITION WHEN THE BOARD IS INSTALLED IN THE P1 SIDE OF THE VME BUS.
1
P2
IRQ
VECTOR INTERRUPT
SET THE INTERRUPT JUMPER IN THIS POSITION WHEN THE BOARD IS INSTALLED IN THE P2 SIDE OF THE VME BUS.
1
P2
IRQ
VECTOR INTERRUPT
1
P2
IRQ
VECTOR INTERRUPT
MAC426
= JUMPER INSTALLED

Figure 1

3.3 AM-214 Compact Systems Controller

The AM-214 is used in the compact AM-1400 and AM-1600 computers. It contains all the circuitry necessary to read, write, and format 3-1/2 inch high density drives. A modification is required to route the high density signal to the interface connector for use with 5-1/4" dual density drives. This modification changes the board revision level from A01 to A02.

3.3.1 AM-214 Jumper Settings

The AM-214 contains 3 jumper blocks, W1, W2, and W3. W1 must always be installed, since it supplies the main clock to the controller. W2 should also be installed, as it allows software selection of the diskette data rate. W3 should be installed the lower position (pins 3 and 4). This setting allows software control of density. Refer to Figure 2 for jumper placement.

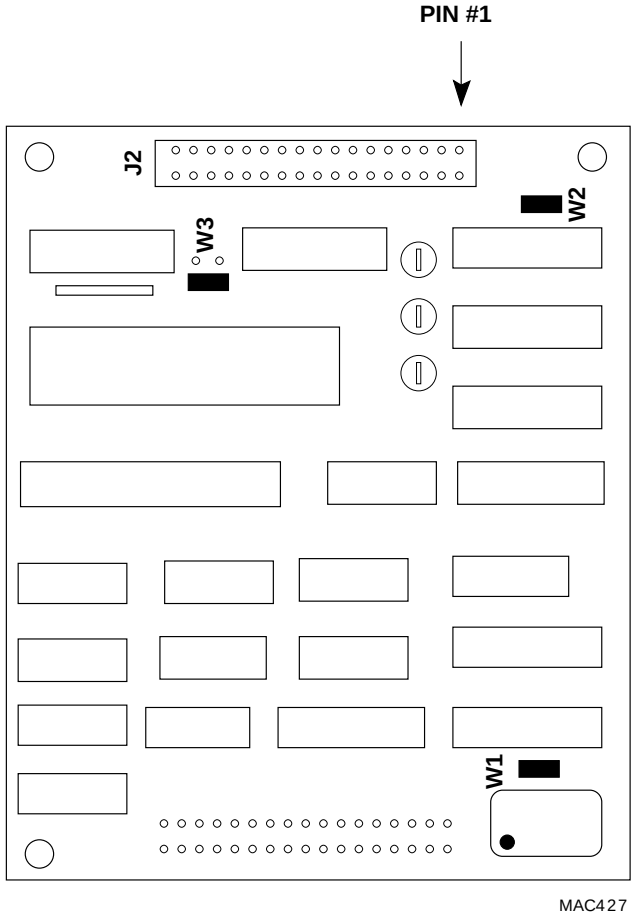


Figure 2

4.0 DISKETTE DRIVE CONFIGURATION

Following is configuration information for all of the dual density diskette drives which have been installed in Alpha Microsystems computers. They include:

- Panasonic JU-475-2 5-1/4"
- Panasonic JU-475-3 5-1/4"
- Panasonic JU-475-4 5-1/4"
- Toshiba ND0801 5-1/4"
- Epson SD-680L 5-1/4"
- Teac FD-55GFR 5-1/4"
- Toshiba ND356T 3-1/2"
- Toshiba ND3561 3-1/2"
- Toshiba ND3561GR 3-1/2"
- Teac FD-235HF 3-1/2"
- Epson SMD-300 3-1/2"

You must have a controller which has been modified for dual density operation before configuring a 5-1/4 inch drive for dual density operation. If you configure the drive for dual density operation without a properly modified controller, you will not read, write, or format properly. The following paragraphs and diagrams discuss each drive configured for fixed and dual density. Fixed density mode is used for AMOS compatibility only. It forces the drive to be in a particular mode at all times. Dual density operation is used for AMOS and VPC operation. It allows the software to determine the operation mode.

4.1 5-1/4 Inch Drive Configuration

In fixed density mode, the drive is set as a low density drive only. On the Panasonic drives, this is controlled by jumper 1M (1 Megabyte mode). In this mode, the drive always operates at low density, 300 RPM speed.

Dual density mode is set up to allow interface pin 2 to control the speed and density. In this mode, the drive may operate in either low density 300 RPM or high density 360 RPM mode, depending on the level of interface pin 2.

4.1.1 Panasonic JU-475-2 Diskette Drive Configuration

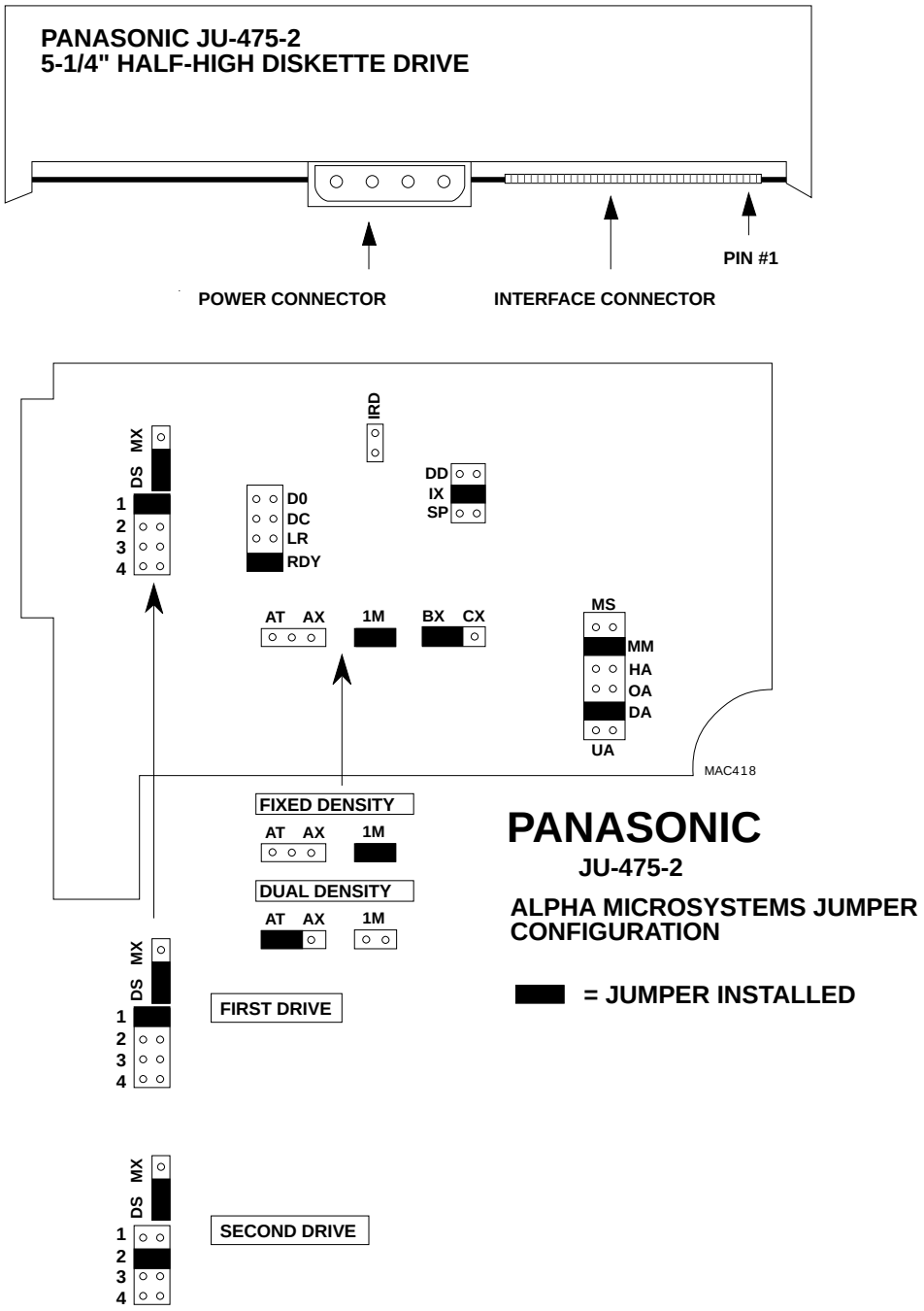


Figure 3

4.1.2 Panasonic JU-475-3 Diskette Drive Configuration

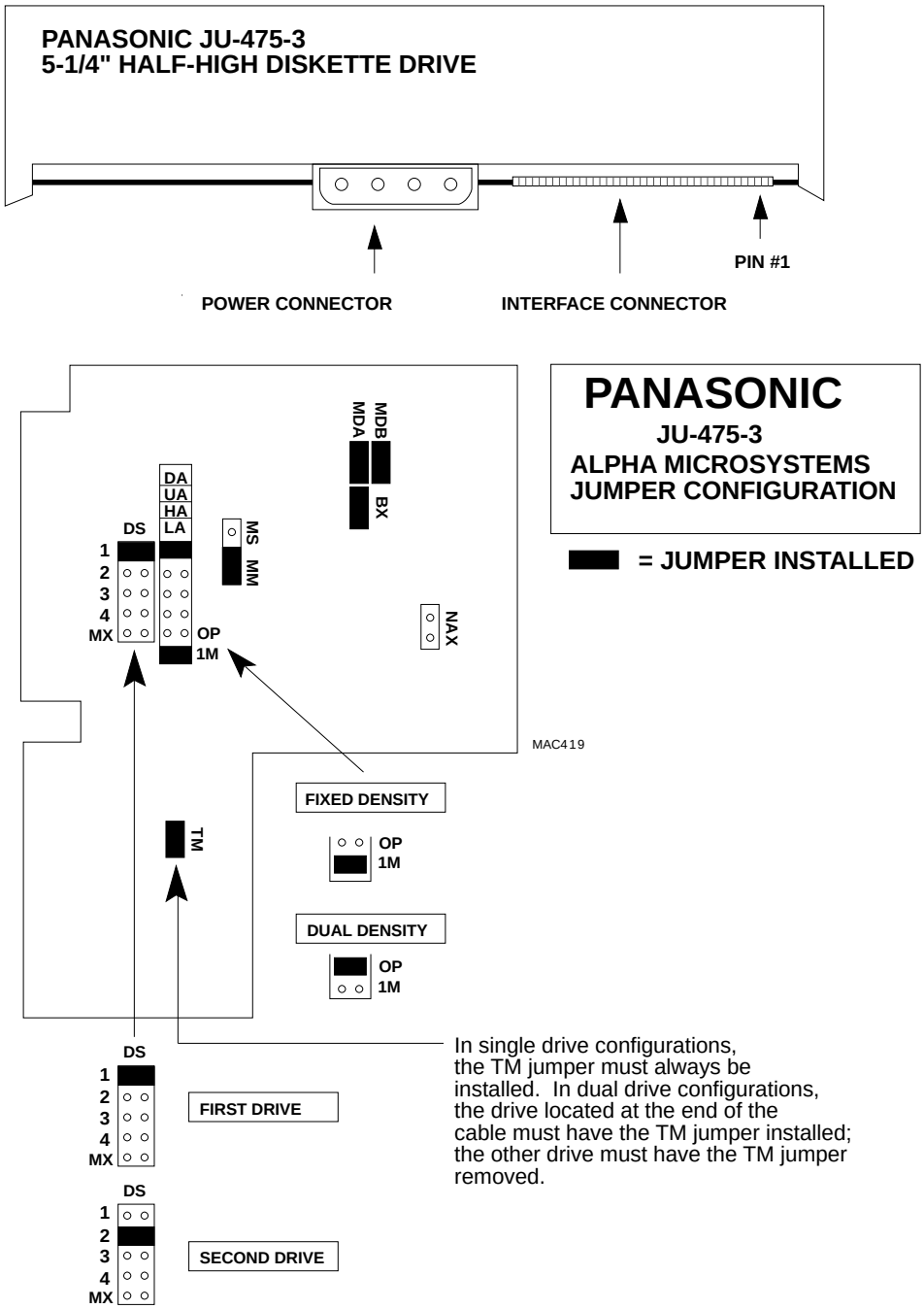


Figure 4

4.1.3 Panasonic JU-475-4 Diskette Drive Configuration

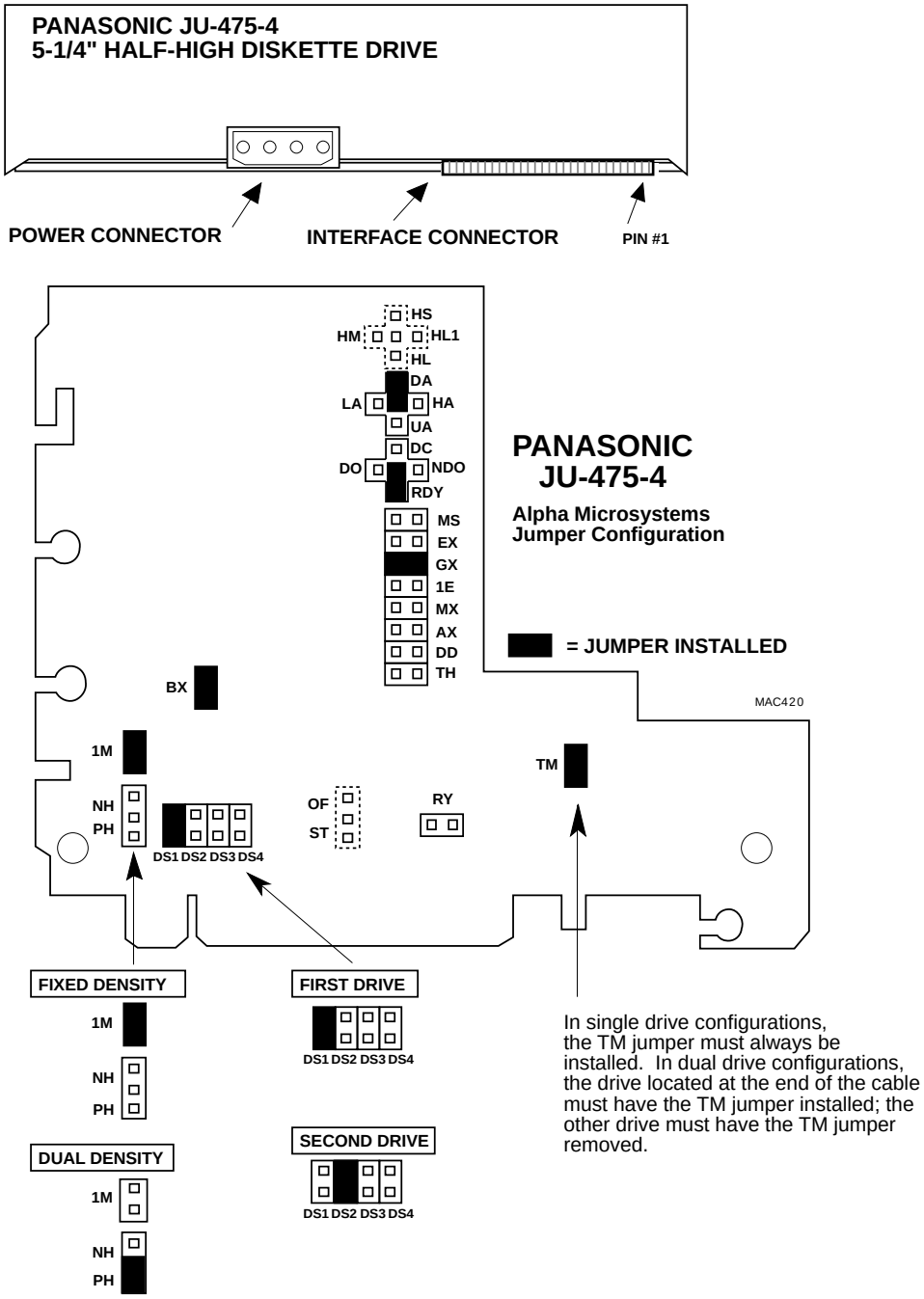


Figure 5

4.1.4 Toshiba ND-0801 Diskette Drive Configuration

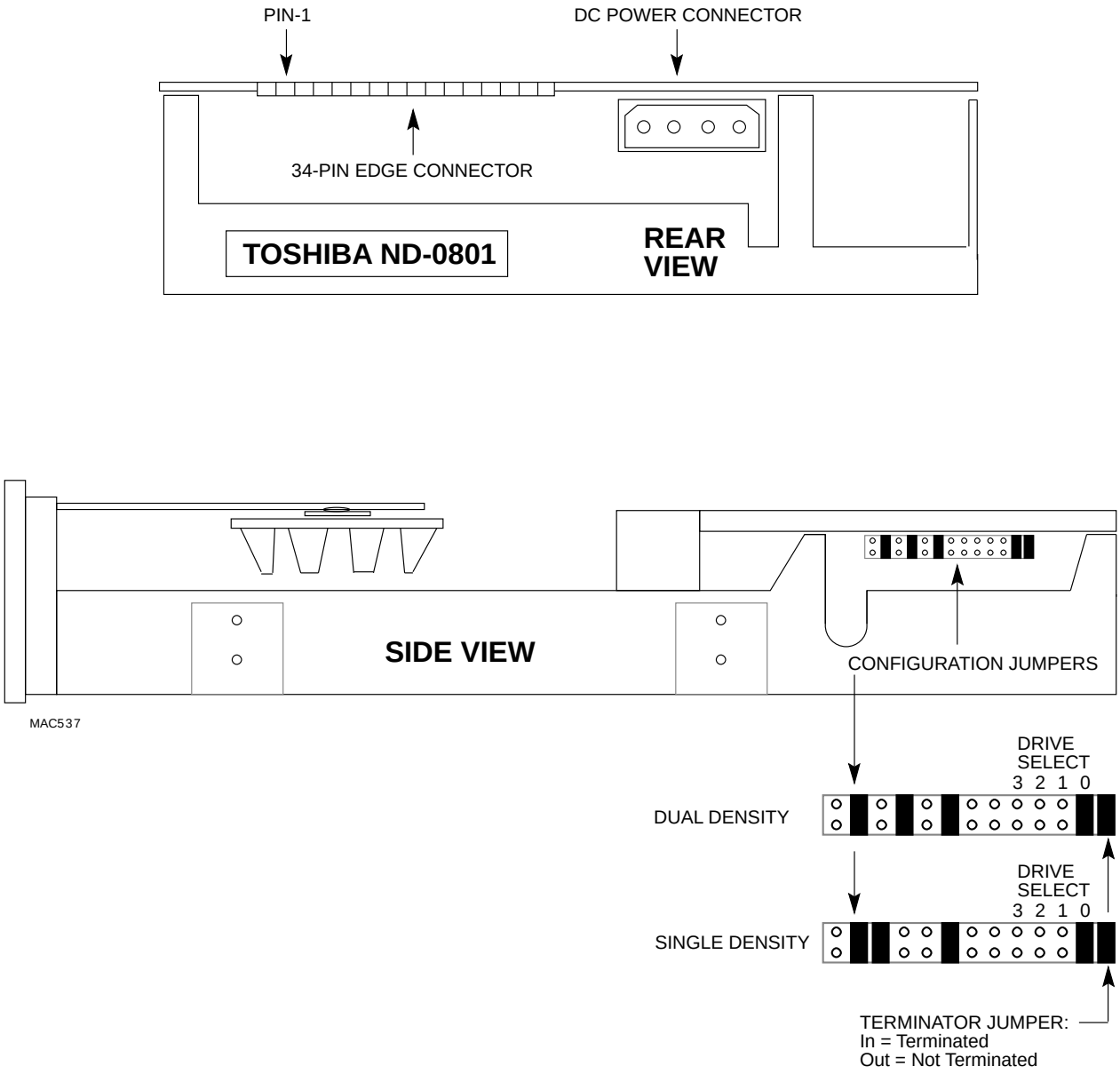
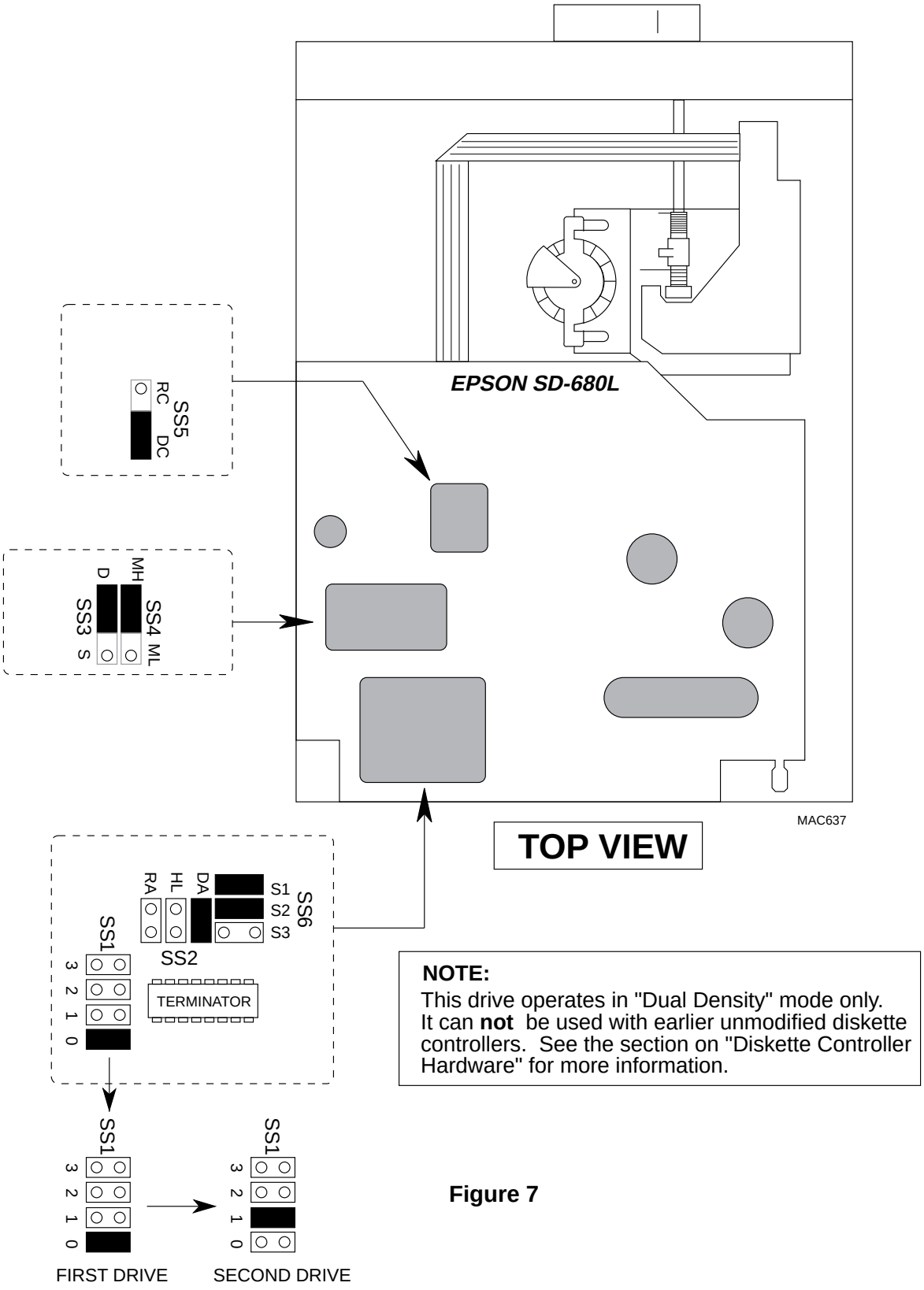


Figure 6

4.1.5 Epson SD-680L Diskette Drive Configuration



NOTE:
This drive operates in "Dual Density" mode only. It can **not** be used with earlier unmodified diskette controllers. See the section on "Diskette Controller Hardware" for more information.

Figure 7

4.1.6 TEAC FD-55GFR Diskette Drive Configuration

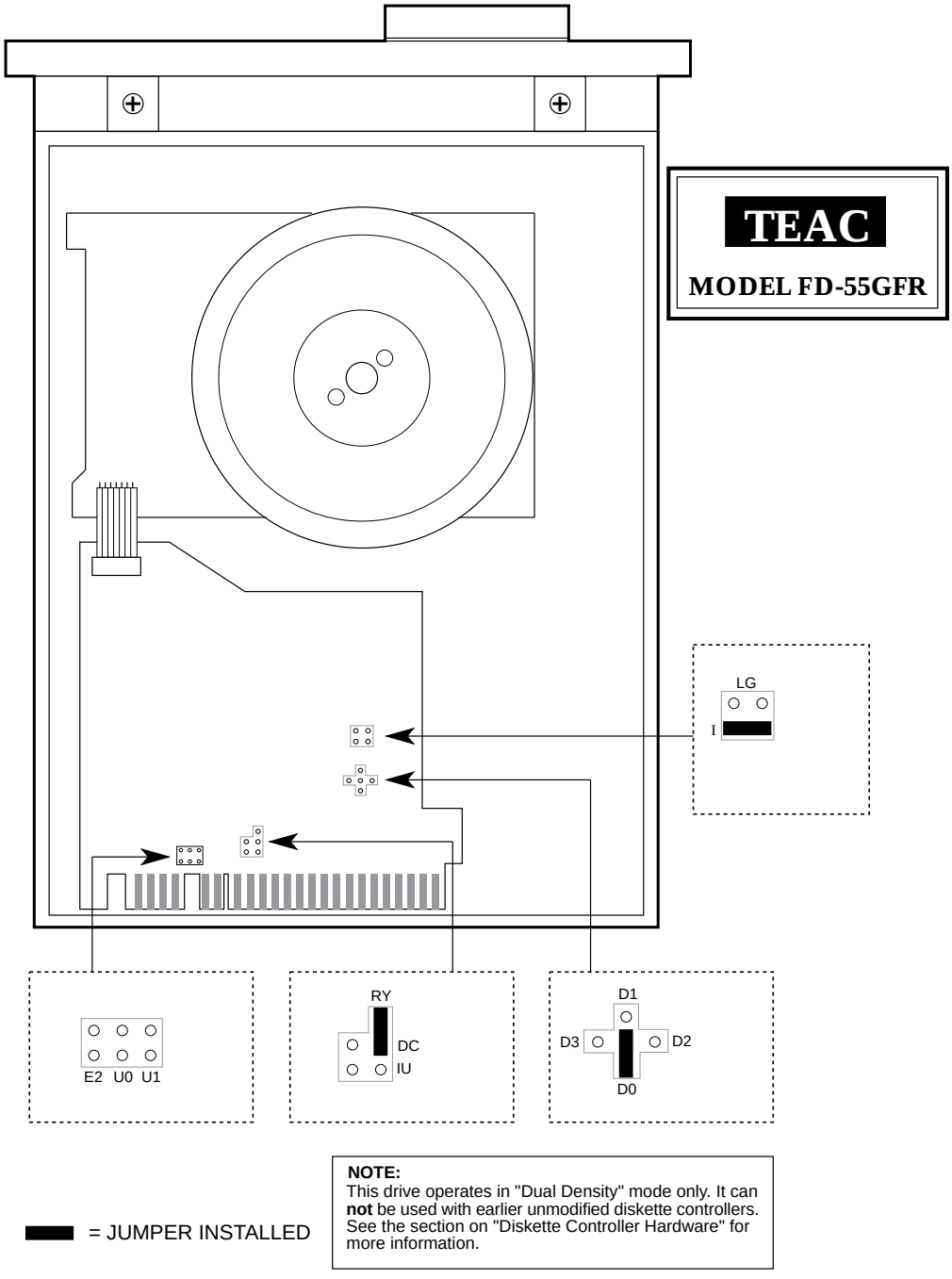


Figure 8

4.2 3-1/2 Inch Drive Configuration

For fixed density operation, these drives are set up to modify density dependent on the state of pin 2. On an unmodified controller, this pin is always in the high density mode by default. With a modified controller, however, the drive would be in the low density mode since pin 2 is, by default, in the low state. To resolve this conflict, the drive should be set up to configure itself by sensing the high density window in the diskette itself. In this configuration, the drive will work in both fixed and dual density modes with a modified or unmodified controller.

4.2.1 Toshiba ND365T Diskette Drive Configuration

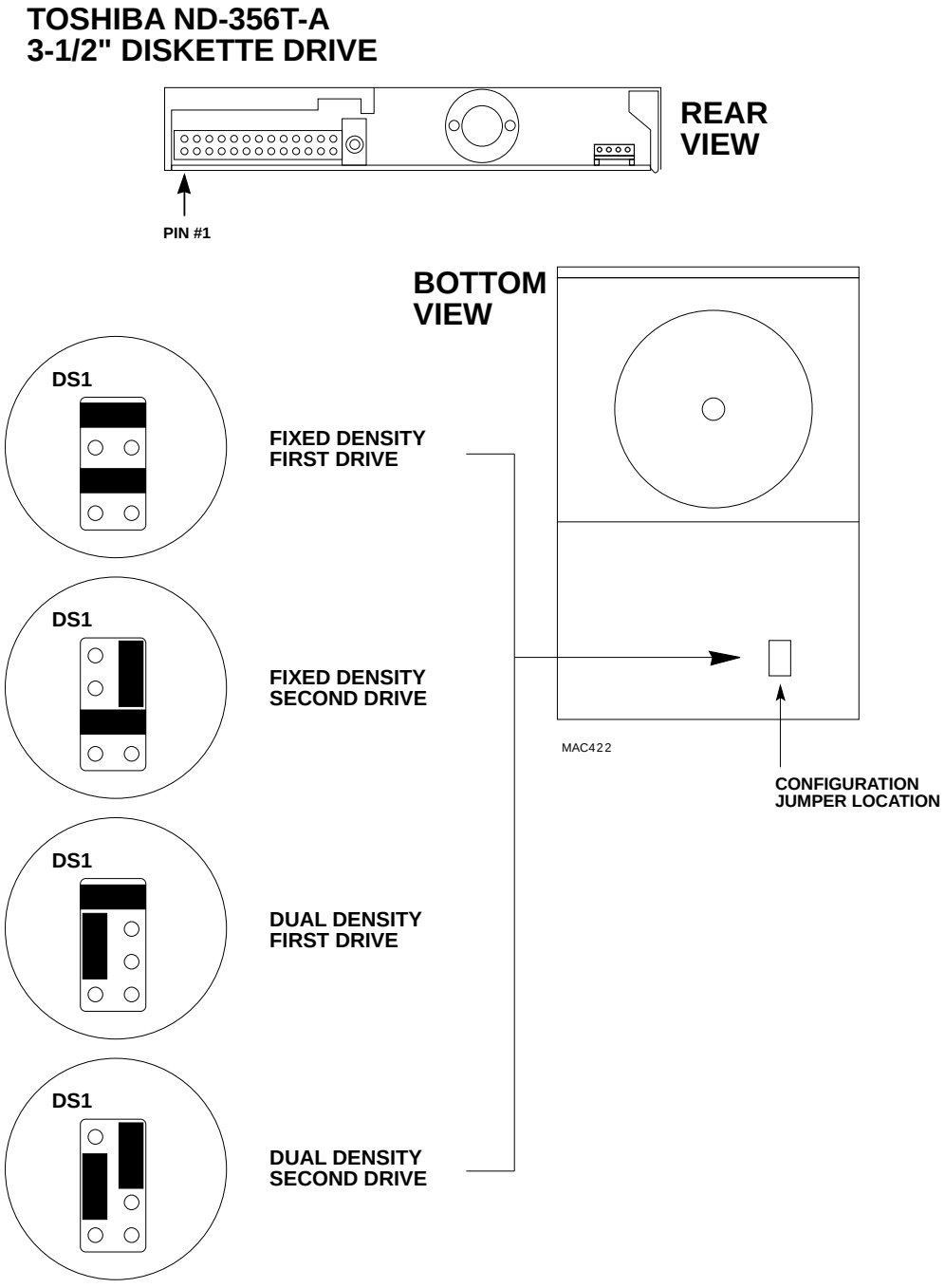


Figure 9

4.2.2 Toshiba ND3651 Diskette Drive Configuration

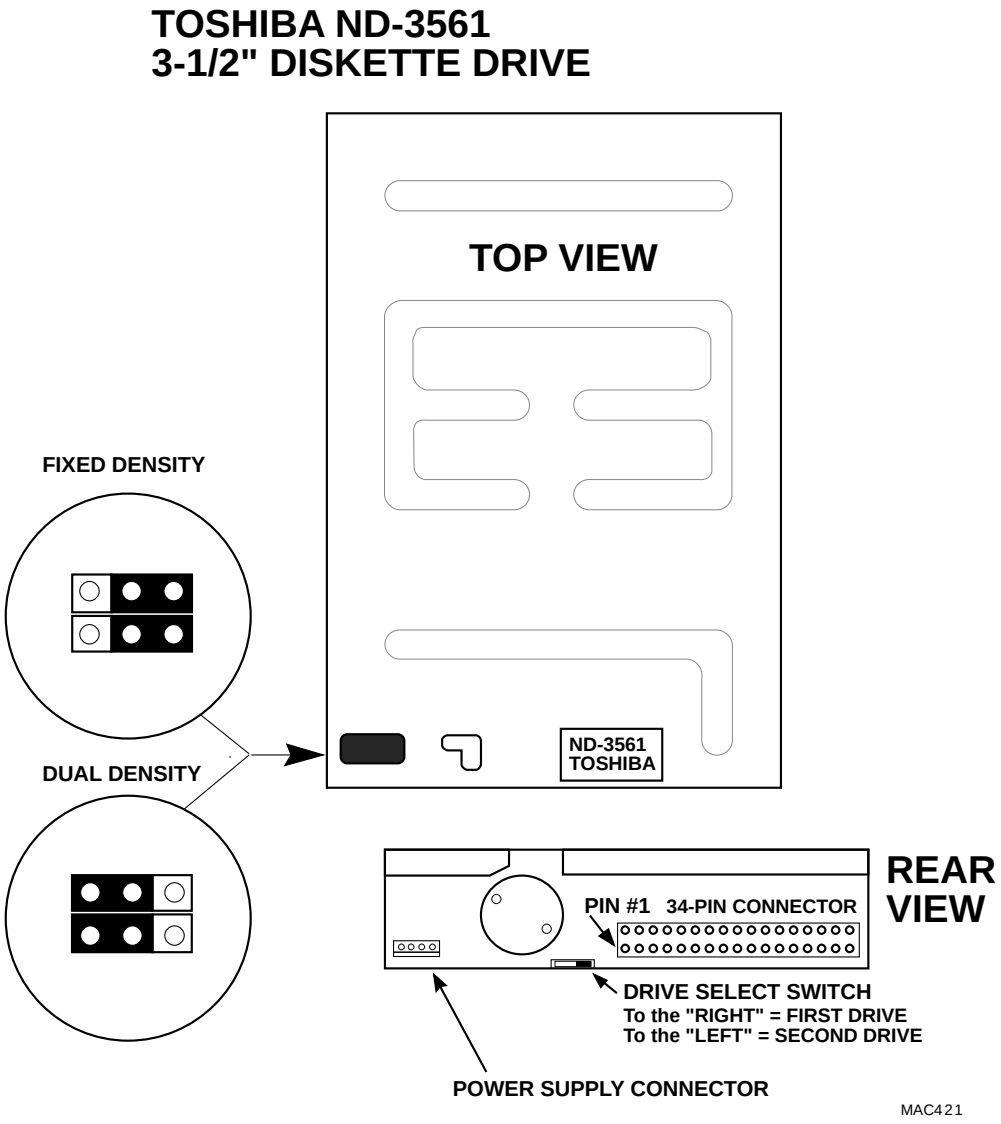
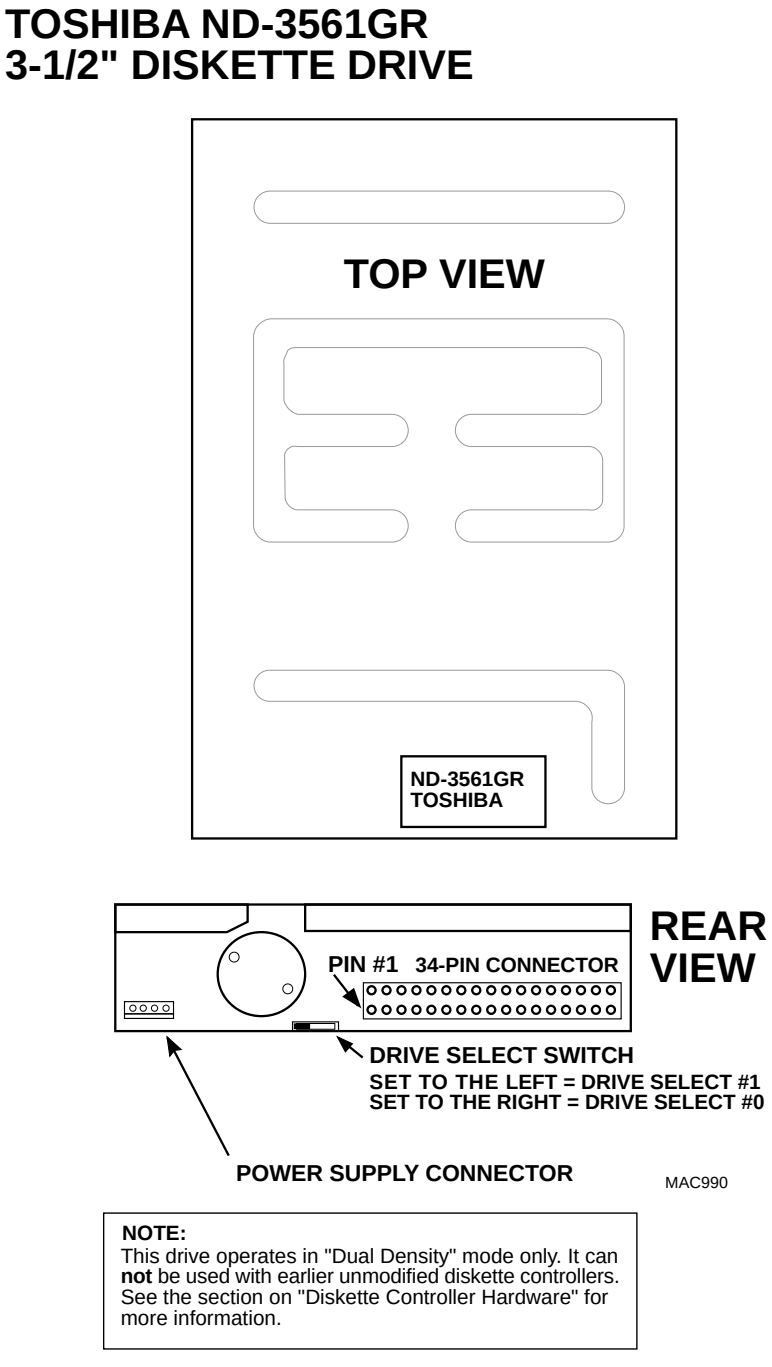


Figure 10

4.2.3∞Toshiba ND3651GR Diskette Drive Configuration



NOTE:
This drive operates in "Dual Density" mode only. It can **not** be used with earlier unmodified diskette controllers. See the section on "Diskette Controller Hardware" for more information.

Figure 11

4.2.4 TEAC FD-235HF Diskette Drive Configuration

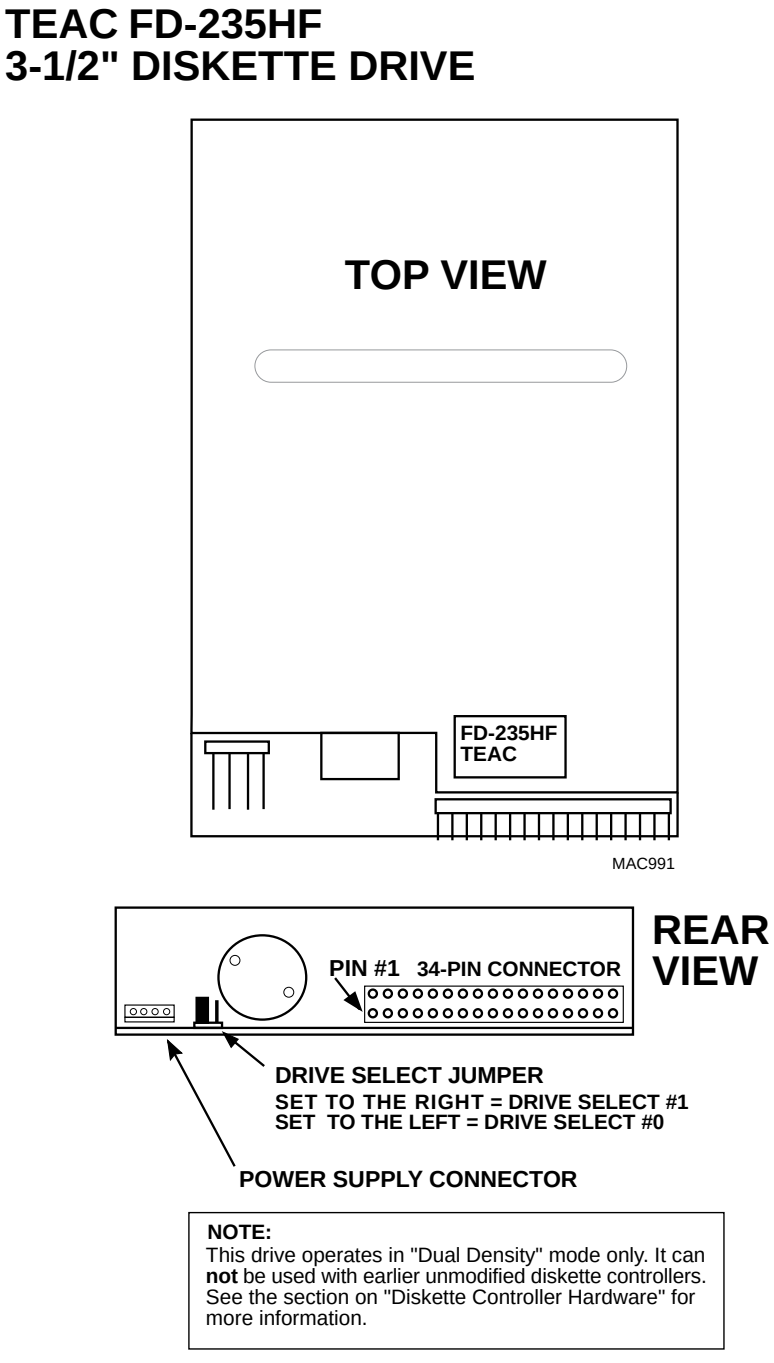
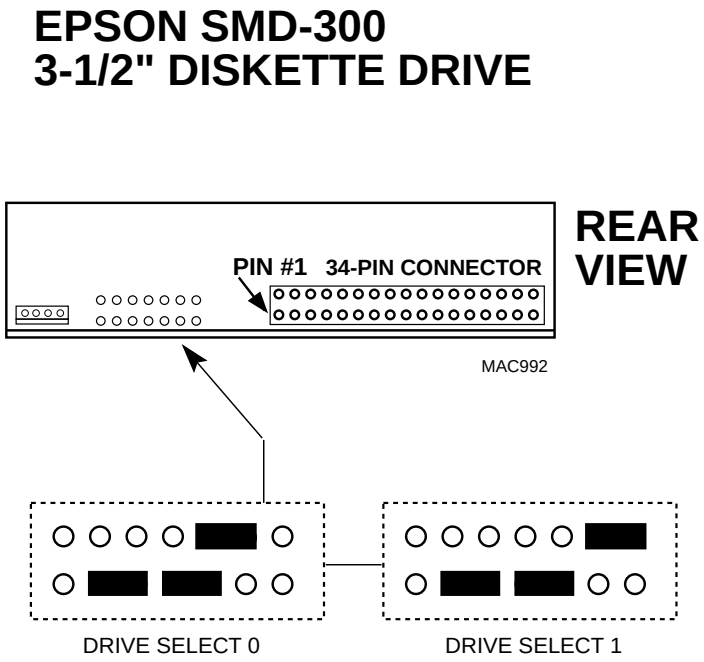


Figure 12

4.2.5 EPSON SMD-300 Diskette Drive Configuration



NOTE:
This drive operates in "Dual Density" mode only. It can **not** be used with earlier unmodified diskette controllers. See the section on "Diskette Controller Hardware" for more information.

Figure 13

4.3 Multiple Drive Installation

Diskette drives may be daisy-chained for dual drive operation. In this mode, the first drive is configured as device 0, and the second as device 1. This is accomplished by setting the proper jumpers on the drives. 5-1/4 inch drives have a jumper marked TM which enables or disables interface line termination. If a 5-1/4 inch drive is set up as the first drive in a multi-drive installation, this jumper should be removed. The second drive may be another 5-1/4 inch or 3-1/2 inch drive. The 3-1/2 inch drives do not have a means of disabling termination. This is not normally a problem, however, as long as the cable lengths between the controller and drive(s) are as short as possible.

Under AMOS, the first unit is drive 0 and the second unit is drive 1. If the formats are not the same, a driver must be built and named for each. For example, if you set up a 5-1/4 inch drive as 0, and a 3-1/2 inch drive as 1, you would create a separate driver for each, using the FIXFLP program. If you named these drivers MIN and FLP respectively, then the 5-1/4 inch drive would be MIN0: and the 3-1/2 inch drive would be FLP1:

Used with VPC, the first drive is diskette A:, and the second drive is diskette B:. The drive types are defined in the VPC configuration file. It is not necessary to create any additional drivers, as VPC controls the drives directly. Please refer to the *VPC User's Guide (part no. DS0-00129-00)* for additional information about VPC diskette operation.

5.0 DISKETTE MEDIA

As mentioned above, is is important to use the proper media type for the drive and density in use. In general, all double density formats may use type 2DD (2 sides, double density, double track). This includes all AMOS 5-1/4 inch formats, 5-1/4 inch 360k VPC mode, and 3-1/2 inch 720k VPC mode. High density modes must use 2HD (2 sides, high density, double track). This includes AMOS 3-1/2 inch, 5-1/4 inch 1.2MB VPC mode, and 3-1/2 inch 1.44MB VPC mode.

6.0 CONTROLLER AND DRIVE COMPATIBILITY CHART

The following chart shows the drive and controller configurations necessary for all of the diskette formats discussed above. For each format, the chart shows whether a drive must be in fixed or dual density mode when used with a modified or unmodified controller. Refer to the specific drive configuration information to set the drive in either fixed or dual density mode. Also shown is the type of media required for each configuration.
All controllers are considered unmodified unless they have been brought up to the following revision levels:

For 16 MHz. AM-2000M (DWB-00145-00)
Rev. A06 or later
Rev. B09 or later
Rev. C04 or later

For 33 MHz. AM-2000M (DWB-00145-33)
Rev. B13 or later
Rev. C08 or later

For AM-212 (DWB-00212-00)
Rev. A05 or later

For AM-214 (DWB-00214-00)
Rev. A02 or later

Controller and Drive Configuration

Diskette Format	Drive Density Mode		Media Type
	Unmodified Controller	Modified Controller	
5-1/4" AMOS (all)	Fixed	Dual	2DD
3-1/2" AMOS	Fixed or Dual	Dual	2HD
5-1/4" 360KB VPC	Fixed	Fixed or Dual	2DD
5-1/4" 1.2MB VPC	Not Available	Dual	2HD
3-1/2" 720KB VPC	Dual	Dual	2DD
3-1/2" 1.44MB VPC	Fixed or Dual	Dual	2HD

APPENDIX A

AM-2000M DISKETTE CALIBRATION

A.1 AM-2000M DISKETTE CONTROLLER CALIBRATION PROCEDURE

Figures A-1 and A-2, which appear on the following pages, will assist you in the installation and adjustment of the WD2791 Diskette Drive Controller Chip. The procedure is as follows:

1. Use the instructions in your *AM-2000M Owner's Manual* for removing the top cover and exposing the AM-145 board.

2. Figure A-1 shows the location (U77) where the WD2791 chip is installed. Make sure the notch on the chip aligns with the notch on the socket. Gently press the chip into the socket, making sure all of the pins are properly seated in the socket.

3. Connect the power cable and the 34-pin interface cable to your diskette drive. In order to do the adjustment procedure, you will need to insert a formatted diskette into the drive. For saftey purposes, the diskette should not have any data on it.

4. Power-up your computer and close the diskette drive door. Before you begin the adjustment procedure, allow the computer to run for at least 20 minutes. This will allow all the components to reach their normal operating temperature.

5. Mount the diskette. Ignore any device errors that may be displayed on your terminal screen.

6. Enter BASIC and type in the following program:

```
IO(247)=0
IO(246)=193
IO(247)=128
IO(247)=192
```

7. Using an oscilloscope, make the adjustments shown in Figure A-2. These adjustments are interactive, so once you have made all three adjustments, you should go back and check each adjustment again. If all the adjustments fall within the tolerances shown in Figure A-2, the procedure is complete.

For best results, the "Data Separator" adjustment (shown at the top of Figure A-2) should be made with a frequency counter. However, if a frequency counter is not available, an oscilloscope can be used to make the adjustment using the instructions shown in Figure A-2.

AM-145 (2000M)
DISKETTE CONTROLLER LOCATION

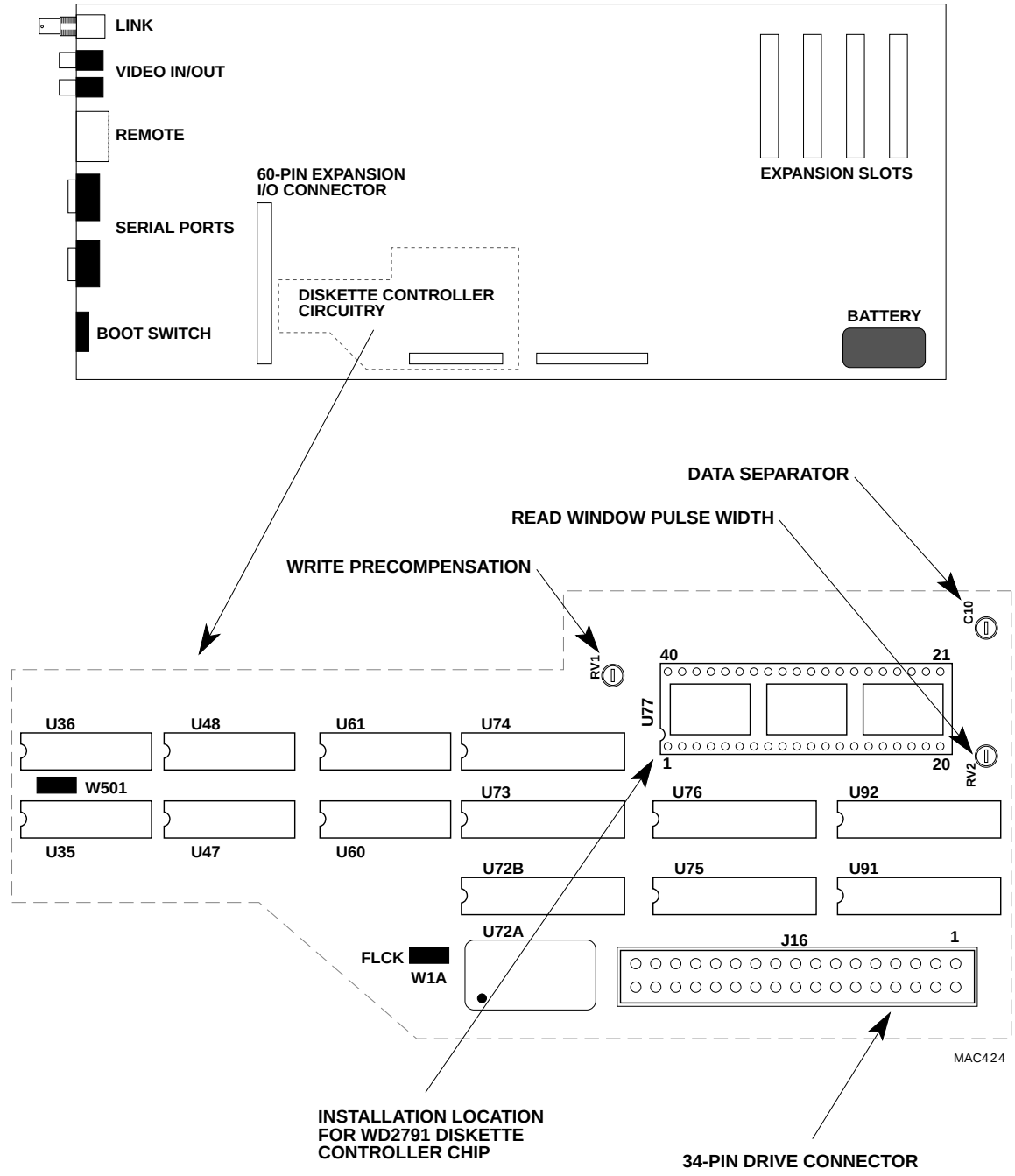
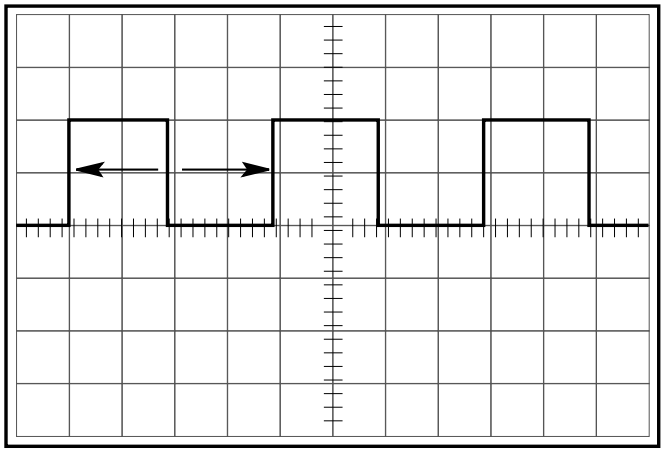


Figure A-1



DATA SEPARATOR

ADJUSTMENT LOCATION = C10

ADJUSTMENT TOLERANCE = 3.85 to 3.95µs

PROBE U77 PIN-16

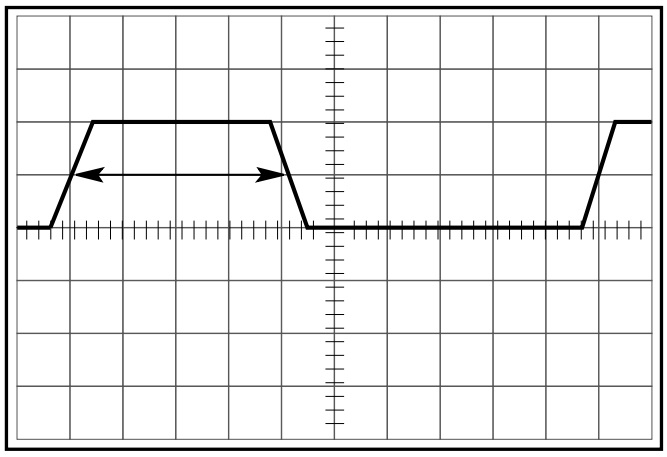
OSCILLOSCOPE SETTINGS

VOLTS = 2v

TIME = 1µs

Note:

Using a "frequency counter" is recommended for this adjustment. The frequency should be set between 253.1 and 259.7 KHz.



WRITE PRECOMPENSATION

ADJUSTMENT LOCATION = RV1

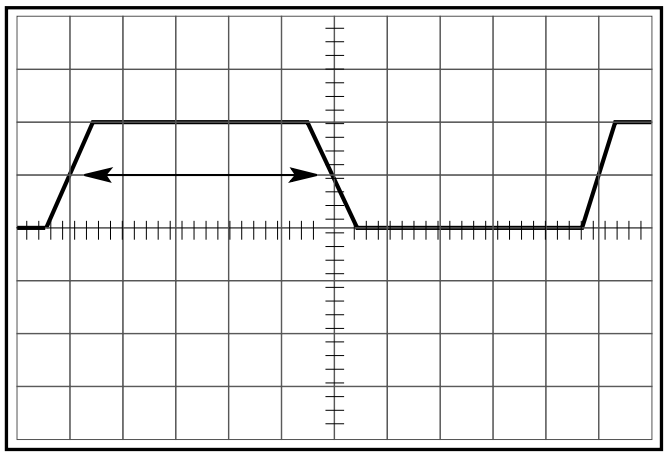
ADJUSTMENT TOLERANCE = 200 to 225ns

PROBE U77 PIN-31

OSCILLOSCOPE SETTINGS

VOLTS = 2v

TIME = .05µs



READ WINDOW PULSE WIDTH

ADJUSTMENT LOCATION = RV2

ADJUSTMENT TOLERANCE = 490 to 510ns

PROBE U77 PIN-29

OSCILLOSCOPE SETTINGS

VOLTS = 2v

TIME = .1µs

MAC425

Figure A-2